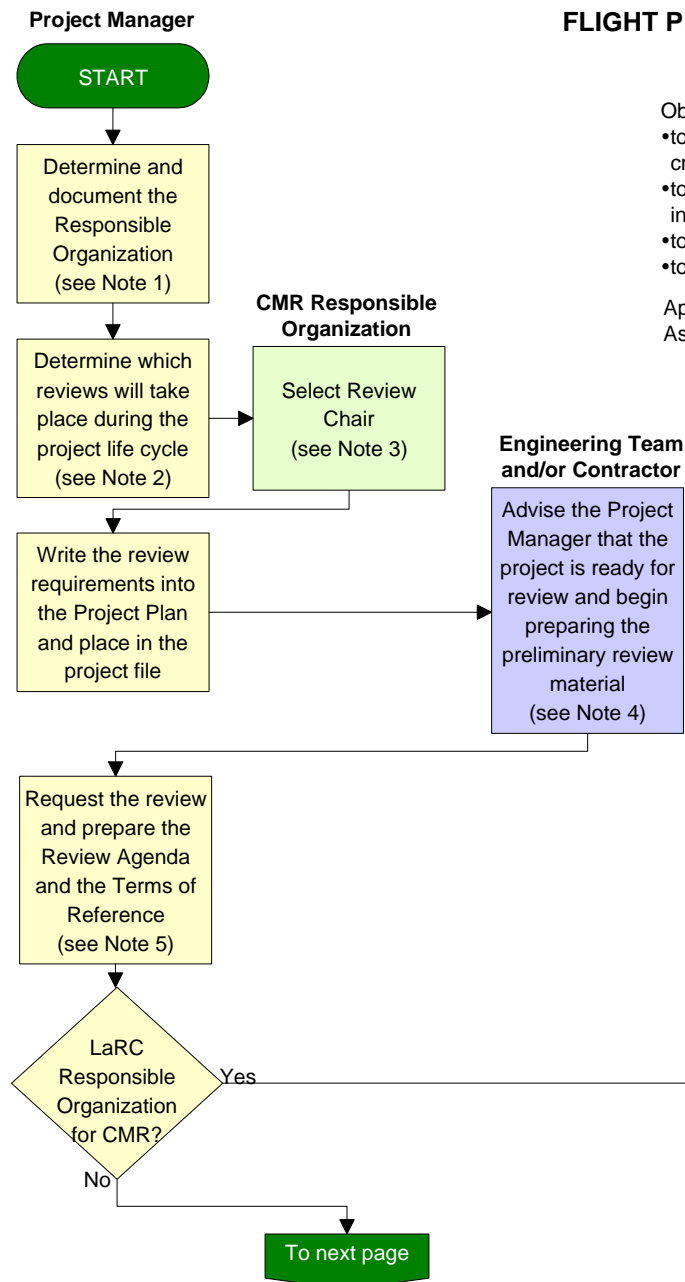# FLIGHT PROJECT CRITICAL MILESTONE REVIEW (CMR) PLANNING AND IMPLEMENTATION

Objectives:
- to assess the technical and programmatic health of LaRC's flight projects with respect to the success criteria and acceptable risk
- to provide LaRC senior management with an independent assessment of the project readiness to move into the next phase
- to enhance the probability of success of LaRC flight missions
- to help assure Center compliance with NPR 7120.5

Approval _____original signed on file_____   ____8/9/06____
Associate Director for Operations   Date

General Note

Applicability: This procedure sets forth the policy and responsibilities for review of flight projects implemented under the management of Langley Research Center (LaRC). Flight projects are defined as any approved NASA Program Management Council (Ref. NPR 7120.5) activity or as an activity designated by the LaRC's Center Management Council (CMC). Other projects not required to follow this procedure may do so if they wish to have formal critical milestone reviews. These requirements do not supersede other reviews imposed by NASA Headquarters, other Centers, nor other LaRC management reviews. Conducting reviews does not relieve the Project Manager, project personnel, nor line management of the responsibility for the success of the project or mission.
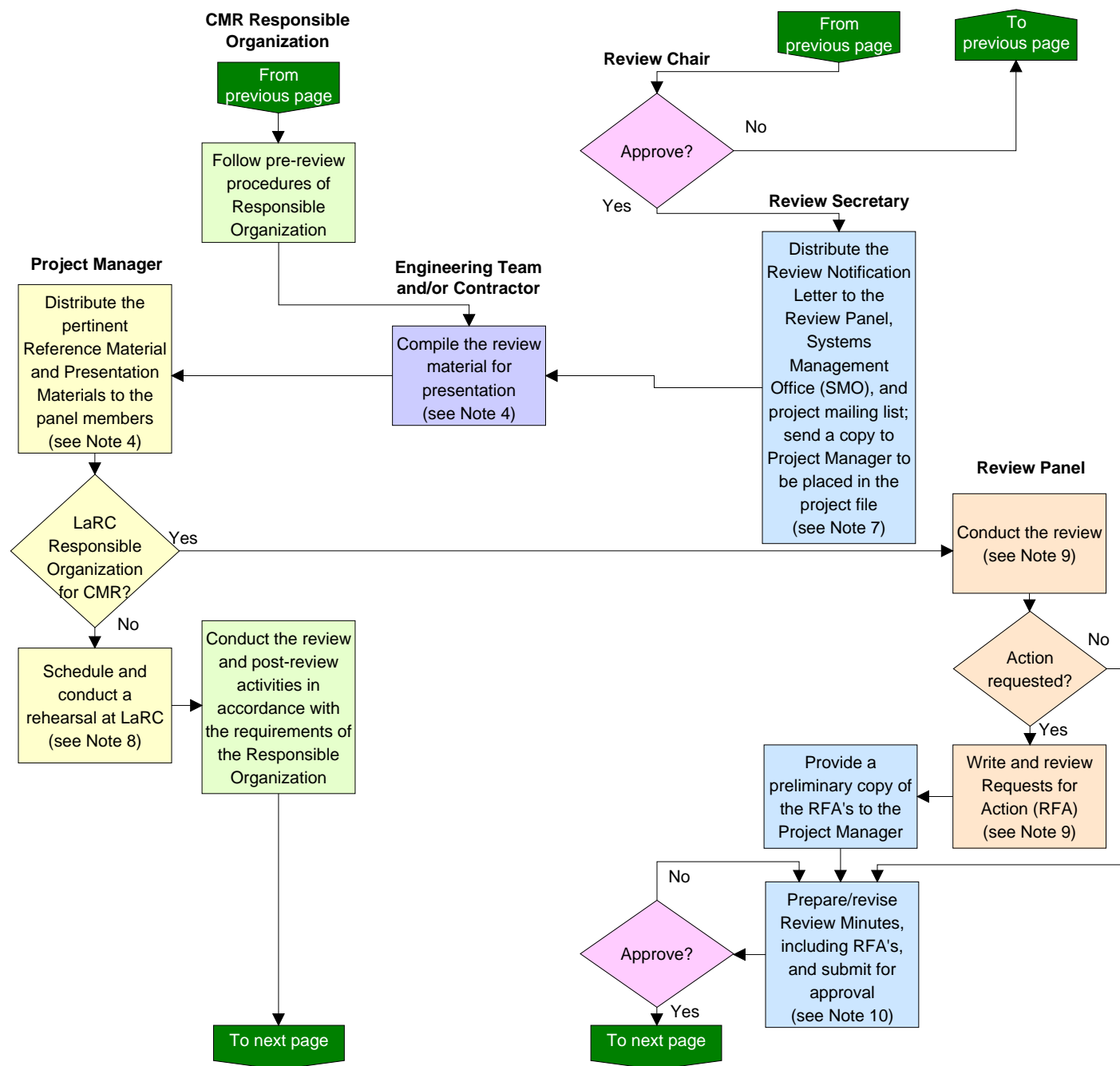
Per NPR 7120.5, Critical Milestone Reviews (CMRs) are a part of the required integrated and comprehensive continuum of reviews, which are to be defined in the Project Plan. For the purposes of this procedure, the term "project" refers not only to formal NPR 7120.5 projects, but generally to temporary endeavors undertaken to create unique products, services, or results. Hence, work formally classified as NASA sub-projects or work-packages under NPR 7120.5 may be subject to these critical milestone review procedures if they are separately reviewed by the LaRC CMC. In such cases, Sub-project Plan or Work-package Plan or other such words should be substituted for Project Plan in what follows. For the purposes of this procedure, Project Manager refers to the individual responsible for the LaRC portion of the work.
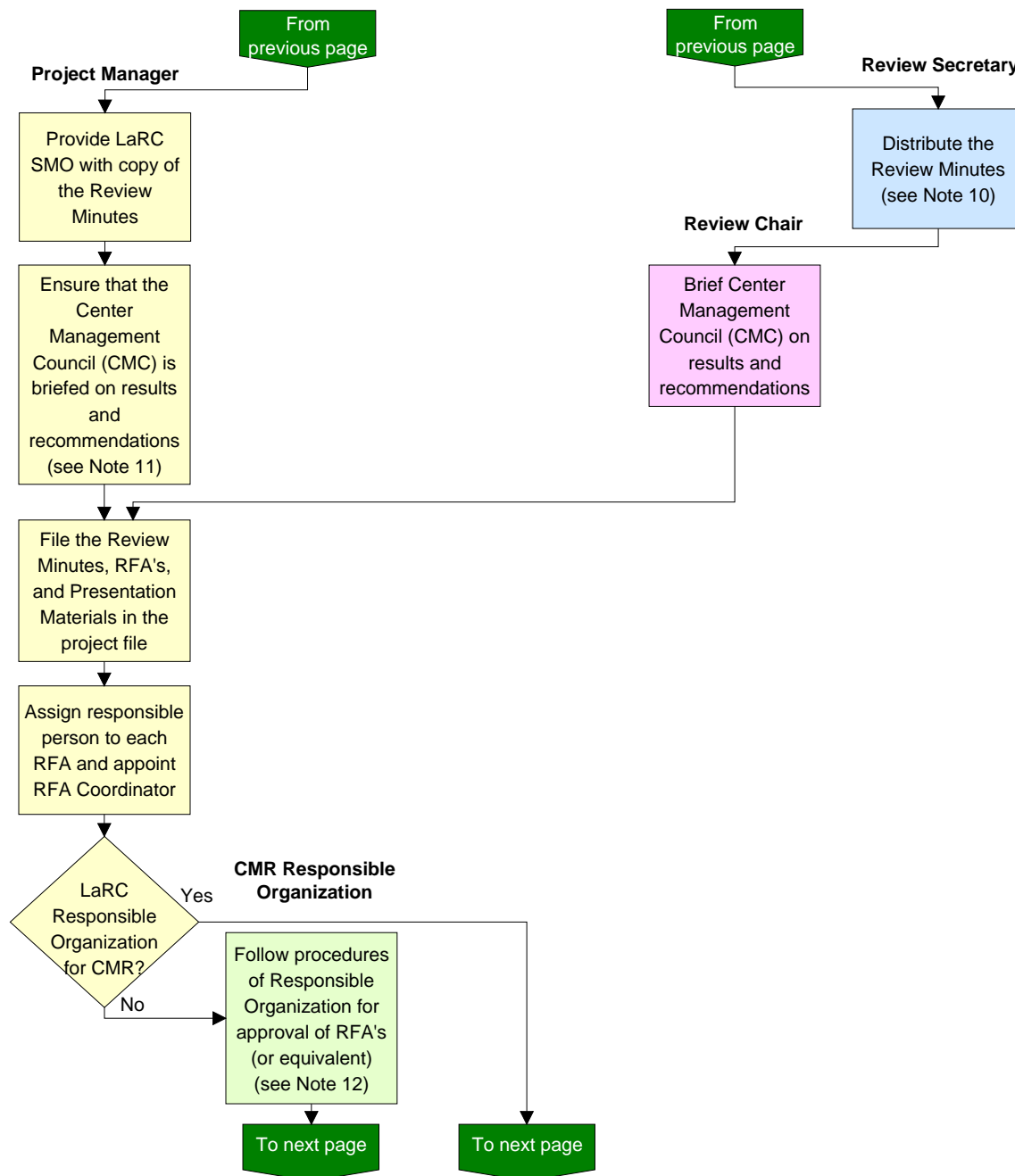
Project Manager

START

Determine and document the Responsible Organization (see Note 1)

Determine which reviews will take place during the project life cycle (see Note 2)

CMR Responsible Organization

Select Review Chair (see Note 3)

Write the review requirements into the Project Plan and place in the project file

Engineering Team and/or Contractor

Advise the Project Manager that the project is ready for review and begin preparing the preliminary review material (see Note 4)

Request the review and prepare the Review Agenda and the Terms of Reference (see Note 5)

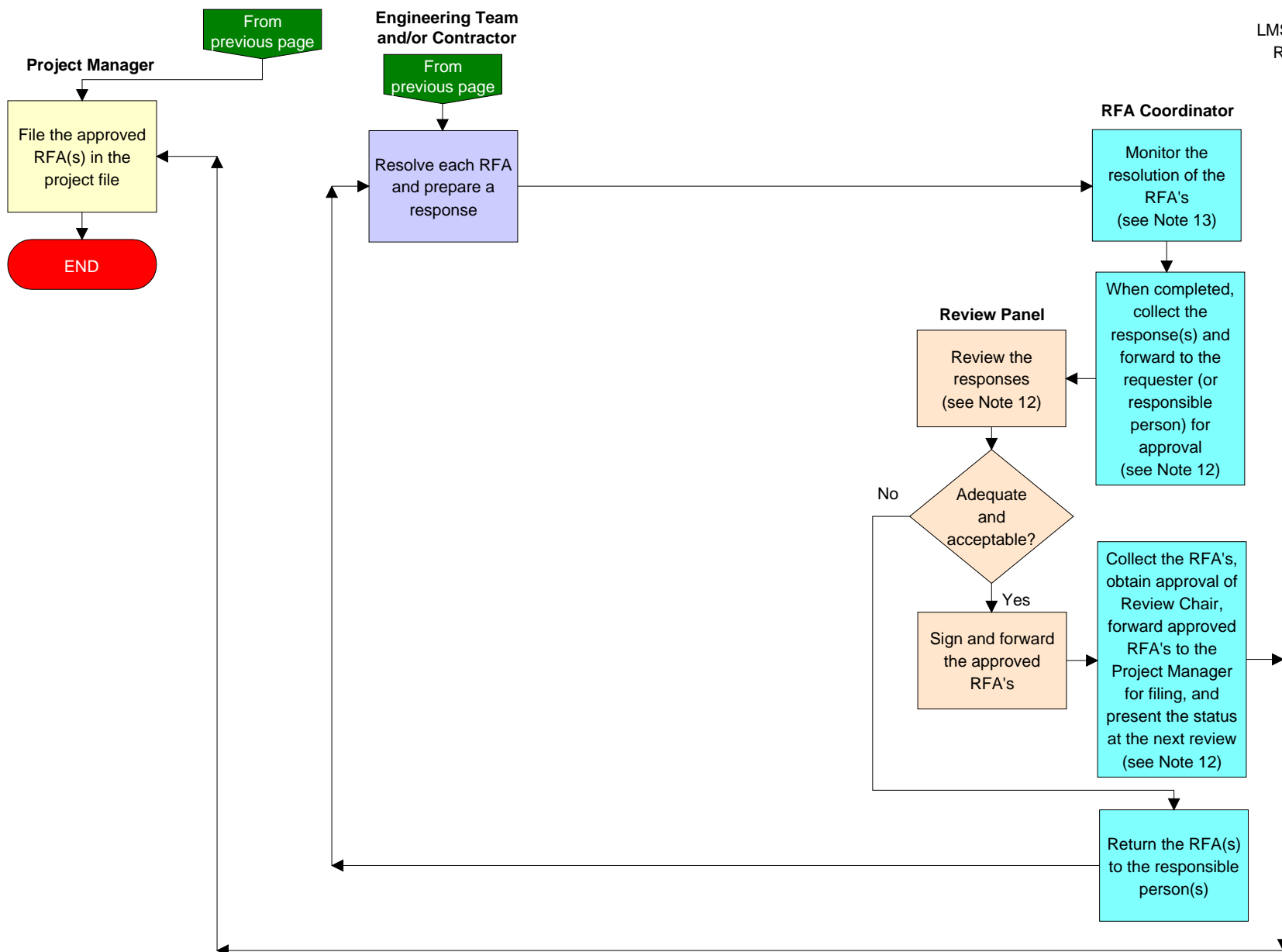LaRC Responsible Organization for CMR?   Yes / No

Review Chair

Contact line management to establish the review panel (see Note 6)

Review Secretary

Schedule the review and prepare/revise the Review Notification Letter (see Note 7)

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CMR Responsible Organization

From previous page

Review Chair

From previous page

To previous page

Follow pre-review procedures of Responsible Organization

Approve?

No

Yes

Review Secretary

Engineering Team and/or Contractor

Distribute the Review Notification Letter to the Review Panel, Systems Management Office (SMO), and project mailing list; send a copy to Project Manager to be placed in the project file (see Note 7)

Project Manager

Distribute the pertinent Reference Material and Presentation Materials to the panel members (see Note 4)

Compile the review material for presentation (see Note 4)

Review Panel

LaRC Responsible Organization for CMR?

Yes

No

Conduct the review (see Note 9)

Action requested?

No

Schedule and conduct a rehearsal at LaRC (see Note 8)

Conduct the review and post-review activities in accordance with the requirements of the Responsible Organization

Yes

Provide a preliminary copy of the RFA's to the Project Manager

Write and review Requests for Action (RFA) (see Note 9)

No

Approve?

Yes

Prepare/revise Review Minutes, including RFA's, and submit for approval (see Note 10)

To next page

To next page

Verify correct revision before use by checking the LMS Web Site

From previous page

Project Manager

Provide LaRC SMO with copy of the Review Minutes

Ensure that the Center Management Council (CMC) is briefed on results and recommendations (see Note 11)

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Review Secretary

Distribute the Review Minutes (see Note 10)

Review Chair

Brief Center Management Council (CMC) on results and recommendations

File the Review Minutes, RFA's, and Presentation Materials in the project file

Assign responsible person to each RFA and appoint RFA Coordinator

LaRC Responsible Organization for CMR?

CMR Responsible Organization

Yes

No

Follow procedures of Responsible Organization for approval of RFA's (or equivalent) (see Note 12)

To next page

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Project Manager

From previous page

Engineering Team and/or Contractor

From previous page

RFA Coordinator

File the approved RFA(s) in the project file

END

Resolve each RFA and prepare a response

Monitor the resolution of the RFA's (see Note 13)

When completed, collect the response(s) and forward to the requester (or responsible person) for approval (see Note 12)

Review Panel

Review the responses (see Note 12)

Adequate and acceptable?

No

Yes

Sign and forward the approved RFA's

Collect the RFA's, obtain approval of Review Chair, forward approved RFA's to the Project Manager for filing, and present the status at the next review (see Note 12)

Return the RFA(s) to the responsible person(s)

General Information

The following records are generated by this procedure and are maintained in accordance with CID 1440.7:
-Project Plan
-Waivers (from review)
-Review Agenda
-Terms of Reference (TOR)
-Notification Letter
-Presentation Materials
-Reference Documents
-Request for Action (RFA)
-Minutes

Note 1
For the purposes of this procedure, Responsible Organization refers to the organization responsible for managing the project (or the portion thereof). If this work is being managed at LaRC, then LaRC is the Responsible Organization. If another NASA center or some outside entity is responsible for the management of the project, then that organization is the Responsible Organization. This procedure applies whether or not LaRC is the Responsible Organization; more detailed requirements are provided for the case in which LaRC is the Responsible Organization. In some cases, an agreement with another NASA center or other outside entity stipulates that LaRC is the Responsible Organization for some reviews and that some other organization is the Responsible Organization for other reviews. The detailed requirements of this procedure would then vary from review to review, depending upon who is the Responsible Organization for that review. Project Mangers having exceptional cases or special circumstances shall meet with a representative of the Langley Systems Management Office (SMO) to determine and document who should be considered the Responsible Organization for which reviews.

Note 2
Langley flight projects shall conduct the following sequential set of CMRs:
-System requirements review (SRR)
-Preliminary design review (PDR)
-Critical design review (CDR)
-System acceptance review (SAR)
-Flight readiness review (FRR)
-Lessons learned review (LLR)

The Project Manager, with consent of the Principal Investigator, or other authorized representative of the customer organization, may submit Waivers (that may be electronic) from reviews on this list to the SMO Director. Waivers are considered granted when approved by the SMO Director. Other special or "ad-hoc" reviews may supplement the above reviews at the request of either the Review Chairperson or the Project Manager. Additional milestone reviews, e.g., Test Readiness Review (TRR), may be added.

Refer to the Content of Reviews section for the purpose, timing, reference documents, content, and criteria for successful completion of each review.

The applicability, depth, and breadth of the reviews are dependent upon the project characteristics such as size, complexity, cost, and risk. Project Mangers shall ensure that appropriate lower level peer reviews are being held.

Note 3
A Review Chair is selected and expected to remain the same for all the reviews for any one project/experiment. However, in cases in which LaRC is not the Responsible Organization, or for which different organizations are responsible for different reviews, the Review Chair may change. The Review Chair may designate an Alternate Chair for a specific review. For cases in which LaRC is the Responsible Organization, the Senior Engineer in the Systems Engineering Directorate is always considered for the position of Review Chair.

Verify correct revision before use by checking the LMS Web Site

Note 4
In general, the Technical Team shall develop review material in accordance with the review guidelines of the Responsible Organization. However, at a minimum, the Technical Team shall meet the LaRC guidelines for review materials as described below in this note.

The Technical Team prepares materials for distribution and presentation during the review that are pertinent to the objectives of the review and include:
-Project documents
-Requirement documents
-Design documentation
-Test procedures and results
-Analysis, modeling or simulation results
-Assembly and test histories
-Test articles
-Software source code
-Photographs or video

There are two types of review materials: reference documentation and presentation materials. Reference documentation consists of that listed in the Content of Review section of this procedure plus other documentation called out in the Terms of Reference (TOR) and any other deemed useful to the reviewers by the Project Manager. The Project Manager shall provide reference documentation at least ten (10) working days in advance of the review and make it available during the review as indicated in the TOR. The Project Manager shall provide an advanced copy of the presentation material (may be electronic) to all panel members at least two (2) working days prior to the scheduled review date. The Project Manager shall provide any last minute changes at the review. The reference documentation shall be the version as indicated in the TOR and under configuration management.

It is expected that reference documentation will have been peer reviewed prior to the CMR, no matter who serves as the Responsible Organization.

Supervisors shall assure the technical quality of review presentations.

Note 5
In general, the Project Manager shall request the review, prepare the Review Agenda, and prepare the Terms of Reference (TOR) in accordance with the review guidelines of the Responsible Organization. However, at a minimum, the Project Manager shall ensure that the TOR information required when LaRC is the Responsible Organization (see details below in this note) is included in the Review TOR or an accompanying document and that the final TOR is approved by the Project Manager, Review Chair, Organizational Unit Manager responsible for the LaRC portion of the Project, and the SMO Director.

For cases where LaRC is the Responsible Organization:

The Project Manager contacts the Review Chair to request a desired review date and develop a Review Agenda and Terms of Reference (TOR). A tentative agenda with allotted times accompanies this request.

The TOR is developed at least two (2) months in advance of the review date .Guidelines, samples, and support for development of a TOR are available from the LaRC SMO.

The following information is included in the Review TOR:
-Point of contact for the project
-Review chair
-Project reference data and documents to be used
-The type, purpose, scope, schedule and resources required for the review
-Proposed team makeup, including organizational affiliation and technical expertise required
-Definition of roles and responsibilities
-A list of parties to be briefed on the final report

The TOR is considered approved when signed by the Project Manager, Review Chair, Organizational Unit Manager responsible for the Project, and the SMO Director.

Note 6

This note applies only to cases in which LaRC is the Responsible Organization.

All LaRC Organizational Units provide support for the reviews. Supervisors shall furnish personnel experienced in the required disciplines, as requested.

The Review Chair shall select panel members on the basis of technical competence and ability to effectively work with the rest of the panel as a team. The Review Chair shall use feedback as to previous panel memberships as a factor in panel selections and consider all significant stakeholder organizations. In order to maintain continuity and efficiency, the panel should remain the same for all the reviews for any one project/experiment.

The SMO Director shall coordinate the NESC Center Chief Engineer's role in the project reviews, i.e., panel member or review notification only.

The Review Chair shall obtain panel membership approval from the SMO Director.

Note 7

This note applies only to cases in which LaRC is the Responsible Organization.

The Review Chair appoints the Review Secretary.

It is the responsibility of the Review Secretary to establish the time and location of the review and obtain the project description and mailing list from the Project Manager to prepare the notification letter. The mailing list shall include:
-Panel Members
-NESC Center Chief Engineer
-Pertinent LaRC Management
-Appropriate NASA Headquarters, Center, or Program Office personnel

The notification letter may be distributed by e-mail and shall include the following:
-Brief project description
-Review objectives
-Day, time, place
-Panel members

Note 8

The Project Manager shall notify the line managers and Organizational Unit Managers (OUMs) of the project team members of the particulars of the scheduled rehearsal and upon request shall provide reference documentation and presentation materials. The scheduled rehearsal shall be sufficiently in advance of the review to allow for comments from the rehearsal to be incorporated into the presentation material.

Note 9

This note applies only to cases in which LaRC is the Responsible Organization.

Panel Members review provided material prior to attending review and commit time for full review period.

Splinter sessions or separate peer reviews may be conducted as part of the CMR as called out in the TOR or as deemed necessary by the Chair.

The products of the reviews are comments on the provided reference documentation and recommendations by the panel on what actions are necessary to get the project ready for the next phase.

Everyone involved in the review process is responsible for providing feedback to the Review Chairperson for improvement opportunities of the review process and panel membership.

Attendees shall document RFAs during a review to recommend remedial action or to gain further knowledge into issues not adequately addressed at the review. Anyone in attendance may submit an RFA for consideration. The Review Secretary shall provide forms for RFA documentation at the review.

The Panel shall critique, consolidate, and provide accepted RFAs to the Review Secretary for distribution. The Review Secretary shall include significant observations or concerns, which do not warrant an RFA, into the Minutes.

Note 10

This note applies only to cases in which LaRC is the Responsible Organization.

The Review Secretary shall obtain approval from the Review Chair and provide the Minutes, including RFAs, to the Project Manager within 1 month of the completion of the review. The Review Secretary shall provide copies of the Minutes to the Review Panel, Review Chair, the NESC Center Chief Engineer, and the SMO Director.

The Project Office is the "Office of Primary Responsibility" and shall maintain the official records. The SMO will maintain a copy of the Minutes for reference.

Note 11
The Project Manager shall ensure that the LaRC CMC is briefed on the results and recommendations of the CMR. However, the Project Manager need not do this in person. In many cases, the OUM of the Project Manager may give the briefing.

Note 12
RFAs (or their equivalents when LaRC is not the Responsible Organization) are considered closed when the responsible person documents resolution and the Requester and Review Chair (or other appropriate persons if LaRC is not the Responsible Organization) sign the RFA.

The Project Manager shall ensure that RFAs are closed by their due dates and that closure status of RFAs is covered at the next review.

Note 13
This note applies only to cases in which LaRC is the Responsible Organization.

The Review Chair appoints an RFA Coordinator from the review team. Either the Review Chair or the Review Secretary would be good candidates for RFA Coordinator, but the final decision rests with the Review Chair.

Verify correct revision before use by checking the LMS Web Site

Content of Reviews

The contents of each review, as defined below, are not meant to be an all-inclusive list. Items may be added or deleted as deemed appropriate by the Project Manager and Review Chair. Each review shall have an individual agenda. Some of the contents may only be covered in the advance review material and not formally presented, and lower level system of interest reviews may be held prior to or during the formal review process. The TOR shall contain the agreed upon review contents.

a.   System Requirements Review (SRR)

(1)   Purpose

(a) This review defines the project objectives and confirms that the system requirements meet the mission objectives, are sufficient to meet the project objectives, and are well understood by the product development team. It also confirms that a concept is presented which identifies lower level systems of interest and their resource allocations.

(b) Successful completion of the SRR will result in recommended approval of the science/mission objectives, system and segment requirements, and subsystem requirement allocations to establish a functional baseline. It will also serve as a prerequisite to proceeding with preliminary design.

(2)   Timing (Entrance Criteria)

The project has performed system trade studies, assessed technology readiness, and selected a System architecture and operational concept that will satisfy negotiated goals and objectives within project constraints.

(3)   Reference Documents Provided

(a) Program Commitment Agreement
(b) Formulation Approval Document
(c) Mission/User Requirements Document
(d) System Requirements Document
(e) System Concept of Operations Document
(f) Draft Project Plan (Ref: NPR 7120.5)
(g) Draft Product Assurance Plan
(h) Draft Configuration Management Plan
(i) Draft System Engineering Management Plan (Ref. NASA SP-6105)
(j) Draft Photographic Documentation Plan

(4)   Contents

(a) Science/mission objectives baseline
(b) Mission operations, including retirement/disposal
(c) System performance requirements with lower level allocations
    (i) Results of requirement document formal review/inspection
(d) Technology readiness and distribution restrictions
(e) Design and development approach
(f) Trade-off studies
    (i). System architecture
    (ii). Operational concept
(g) System requirement verification and validation approach
(h) High-risk areas and risk management
(i) Project plan
    (i)   Work breakdown structure (WBS)
    (ii) Life Cycle Cost
    (iii) Schedule
    (iv) Resources
    (v) Reviews

Verify correct revision before use by checking the LMS Web Site

(j)   Configuration management
(k) Photographic documentation plan
(l)   Safety and Mission Assurance
(m) Security Considerations
(n) Organizational Interfaces
(o) Results of formal requirement document reviews
(p) Relevant lessons learned from prior projects
(q) Lessons learned from current project

(5)   Criteria for Successful Completion

(a) Science and mission objectives have been established and documented.
(b) Technology development issues and related high-risk areas are identified with mitigation plans.
(c) Trade-off studies are presented which support the selection of the proposed concept.
(d) Evidence is presented that the proposed concept will meet the system requirements, satisfy the mission objectives, and address operational needs within the project constraints.
(e) Appropriate system performance requirements and preliminary subsystem allocations have been established and documented.
(f)   The cost and schedule are valid in view of the system requirements and selected architecture.
(g) Appropriate project and development plans are presented.
(h) A complete validated set of system requirements are in place and an end item product acceptance criteria is documented.

b.   Preliminary Design Review (PDR)

(1)   Purpose

(a) The PDR is held at the system, subsystem, and component level to ensure the system requirements are complete and have been allocated and to demonstrate preliminary designs meet system functional and performance requirements with acceptable risk (technical performance, cost, and schedule) and are verifiable.

(b) Successful completion of the PDR will result in recommended approval of the system performance allocations, the preliminary design, and the project plan to establish a "design-to" baseline. It will also serve as a prerequisite to proceeding with detailed design.

(2)   Timing (Entrance Criteria)

The project is ready to baseline the system performance and functional allocations, budget, and schedule. All segment, element, and subsystem preliminary designs are complete and meet system performance and subsystem functional requirements. All requirements traceability, verification and validation methodologies, and interfaces are identified. Some development build/test and detail design may have been done.

(3)   Reference Documents Provided

(a) Project Plan (Ref: NPR 7120.5), ready for approval
(b) Baseline Mission/User Requirements Document
(c) Baseline System Requirements Document
(d) Baseline System Concept of Operations Document
(e) Baseline Safety & Mission Assurance Plan
(f)   Baseline Configuration Management Plan
(g) Baseline Photographic Documentation Plan
(h) Baseline System Engineering Management Plan (Ref. NASA SP-6105)
(i)   Baseline Integration, Test & Verification Plan
(j)   Baseline Continuous Risk Management Plan
(k) Baseline WBS with dictionary
(l)   Baseline Integrated Schedule
(m) Life-Cycle Cost Estimate at Completion by year

(n) Baseline Segment Requirements Documents
(o) Baseline Element Requirements Documents
(p) Draft Subsystem Requirements Documents

(4)   Contents

(a) Science/mission objectives review
(b) System performance and functional allocations baseline
(c) Results of requirement document formal review/inspection
(d) RFA status
(e) Design solution
  (i)   Subsystem review reports
  (ii)   Design description
  (iii) Satisfaction and traceability of performance requirements
  (iv)   Resource margins
  (v)   Changes from the SRR design approach
  (vi)   Supporting analyses and tests
  (vii) Acceptable risk
  (viii) System architecture
  (ix)   External interfaces, including research platform (e.g., spacecraft) launch vehicle, and other enabling systems
  (x)   Technical standards used and impacts of revisions/changes
  (xi)   Preliminary fabrication/procurement plan
(f) Safety, including design considerations, e.g., margin and redundancy, flight, range, and operations
(g) Project plan baseline
  (i)   WBS
  (ii)   Cost
  (iii) Schedule
  (iv)   Resources
  (v)   Configuration management plan
  (vi)   Photographic Documentation Plan
  (vii) Product assurance plan
  (viii) Risk management
(h) Procurement plan
  (i)   Subcontracts
  (ii)   Components
(i) Mission operations, including ground operations
(j) Orbital Debris Plan
(k) Trade-off studies
(l) Ground support equipment
(m) Development plan
  (i)   Breadboard, engineering model, and flight build schedule and strategy
  (ii)   System performance requirement verification and validation plan
  (iii) Integrated test plan
  (iv)   Calibration plan
(n) Logistics
  (i)   Contamination control
  (ii)   Servicing
  (iii) Spares
  (iv)   Testing
  (v)   Transportation
  (vi)   Assembly and integration
  (vii) Repairability
  (viii) Facilities
(o) De-scope plan
(p) Relevant lessons learned from prior projects
(q) Lessons learned from current project

(5) Criteria for Successful Completion

(a) There is evidence that the preliminary design is sufficiently complete and there is high probability that it will meet performance, cost, and schedule as planned.
(b) Overall system architecture has been established and all the external interfaces have been identified and defined.
(c) All system, subsystem, and significant component functional and performance allocations are complete and ready for formal approval.
(d) The proposed design does not violate any safety requirements, which will endanger human life or mission success.
(e) The reliability analysis is based on a sound methodology and presents realistic predictions for logistics planning and life cycle cost analysis.
(f) The design solution is producible based on existing processes and techniques; if not, risk areas which require unique and unproven processes are identified and plans established.
(g) Long-lead items that threaten schedule compliance have been fully justified, and contingency plans have been provided.
(h) Required resources (workforce and facilities) are available to proceed further.
(i) An acceptable operations concept has been developed and the proposed design supports the intended end users' ability to operate the system and perform the mission effectively.
(j) All assembly, integration, and verification test plans have been presented.
(k) The production, verification, operations, and other specialty engineering organizations have reviewed the design.
(l) The plans and design specifications provide sufficient guidance, constraints, and system requirements for the design engineers to execute the design.
(m) The available project reserves and schedule slack are sufficient to proceed.

c. Critical Design Review (CDR)

(1) Purpose

(a) The CDR is held at the component, subsystem, and system level to demonstrate detailed designs meet system functional and performance requirements and specifications established at PDR with acceptable risk (technical performance, cost, and schedule), to ensure the design has been satisfactorily reviewed by production, verification, operations, and other specialty engineering organizations, and to ensure production processes and controls are sufficient to proceed to fabrication. All performance specifications, verification and validation plans, and interfaces are identified. All technical problems and design anomalies are resolved without compromising science/mission objectives, reliability, and safety.

(b) Successful completion of the CDR will result in recommended approval for the detailed design and verification plans to establish a "build-to" baseline and serve as a prerequisite to proceeding with fabrication of the flight system.

(2) Timing (Entrance Criteria)

The detail design phase has been completed. The project is ready to start fabrication, integration, testing, and go under configuration management based on this design baseline. As outlined in the fabrication plan at PDR, fabrication and/or procurement of some long-lead flight items may need to be started prior to this review. In these exceptional cases, project management should carefully evaluate the maturity of the design and the necessity of early start before proceeding.

(3) Reference Documents

(a) Baseline Project Plan (Ref: NPR 7120.5)
(b) Baseline System Requirements Document
(c) Baseline Safety & Mission Assurance Plan
(d) Baseline Configuration Management Plan
(e) Photographic Documentation Plan
(f) Baseline System Integration, Test & Verification Plan

(g) Baseline Integrated Schedule
(h) Baseline Segment Requirements Documents
(i) Baseline Element Requirements Documents
(j) Baseline Subsystem Requirements Documents
(k) Baseline GSE Requirements
(l) Draft Mission Operations Plan
(m) Draft System Acceptance Test Procedure with traceability to System Requirements
(n) Draft Contamination Control Plan
(o) Baseline Configuration Item List
(p) Configuration Audit Status/Reports

(4) Contents

(a) Science/mission objectives review
(b) RFA status
(c) Baseline detail design
    (i)   Subsystem review reports
    (ii)   Changes from the PDR baseline design
    (iii) Supporting analyses
    (iv) Performance requirements
    (v)   Interfaces, including spacecraft and launch vehicle
    (vi) Reliability analysis
(d) Safety
(e) Project plan status
    (i)   Cost
    (ii)   Schedule
    (iii) Resources
    (iv) Configuration management status
    (v)   Photographic documentation status
    (vi) Product assurance plan
    (vii) Risk management
(f) Procurement plan status
    (i)   Subcontracts
    (ii)   Components
(g) Mission operations plan, including ground operations
    (i)   Flight operations team/training plans
    (ii)   In-orbit checkout plan
    (iii) Launch and deployment activities
(h) Ground support equipment
(i) Development plans and status
    (i)   Build plan and status
    (ii)   System performance verification plan and status test results
    (iii) Calibration plan and status
    (iv) Trend analysis plan
(j) Logistics
    (i)   Contamination control
    (ii)   Servicing
    (iii) Spares
    (iv) Testing
    (v)   Transportation
    (vi) Assembly and integration
    (vii) Repairability
    (viii) Facilities
(k) Data retrieval and analysis
(l) Lessons learned

(5)   Criteria for Successful Completion

(a) There is substantial evidence that the detailed design is complete, i.e., traceable to and covers and requirements, and will meet performance, cost, and schedule as planned.
(b) All fabrication drawings and software specifications have been completed with a complete inventory of bill of materials including any long lead items.
(c) All development testing successfully concluded; solutions are identified or in hand.
(d) All appropriate engineering analyses are complete and accurate; the detailed design is based on these results.
(e) Integrated safety analysis shows that any outstanding hazards can be controlled and are within an acceptable risk level.
(f) The integrated logistics analysis shows complete spares provisioning for the life of a program.
(g) All internal interfaces are defined and external interfaces are current.
(h) Quality assurance and production plans are in place and reasonable.
(i) A comprehensive system verification and validation approach (that minimizes on-orbit checkout risks for flight systems) has been established.

d.   System Acceptance Review (SAR)

(1)   Purpose

(a) The purpose of the SAR is to examine the system, its end items and documentation, and test data and analysis that support verification and qualification and to ensure the system meets acceptance criteria and that there is a high level of confidence that the flight item has complied with mission requirements and specifications, that the documentation delivered with the system is complete and current, that it and its ground support equipment will be transported safely to their destination, and that they will operate as designed upon arrival.

(b) Successful completion of the SAR will result in recommendation that the system be accepted and authorization given to ship the system end items to the launch/deployment site or operational facility and to install software and hardware for operational use. It will also establish an understanding of the capabilities and operational constraints of the "as-built" system.

(2)   Timing

The flight system is ready for acceptance by the Center. The fabrication, assembly, and testing have been completed, and all anomalies have been addressed and corrected.

(3)   Reference Documents

(a) Baseline Project Plan (Ref: NPR 7120.5)
(b) Baseline Safety & Mission Assurance Plan
(c) Baseline Configuration Management Plan
(d) Baseline Photographic Documentation Plan
(e) Baseline System Integration, Test & Verification Plan
(f) Baseline Integrated Schedule
(g) Baseline Mission Operations Plan
(h) Baseline System Acceptance Test Procedure
(i) System Test Results/Reports
(j) Safety Review Reports
(k) Baseline Contamination Control Plan
(l) Baseline Transportation Plan
(m) Configuration Audit Status/Reports
(n) As-built drawings, photos, and source code

(4)   Contents

(a) Science/mission objectives review
(b) RFA status

(c) Changes from CDR baseline review
   (i) Subsystem review reports
(d) Project plan status
   (i) Cost
   (ii) Schedule
   (iii) Resources
   (iv) Documentation review
   (v) Photographic documentation review
   (vi) Product assurance
   (vii) Risk assessment
(e) System performance requirements verification status
   (i) Test results
   (ii) Trend data
   (iii) Measured test margins vs design estimates
(f) Calibration plan and status
(g) Mission operations plan baseline
   (i) Contingency plans
(h) Safety
   (i) Status of safety reviews
(i) Transportation plan
(j) Ground support equipment
(k) Carrier integration and test plan
   (i) Launch preparation plan
(l) Logistics
(m) Data retrieval and analysis
(n) Lessons learned

(5) Criteria for Successful Completion

(a) The project has demonstrated compliance with mission requirements and specifications. There are no open items remaining before acceptance.
(b) Testing has demonstrated that the system is flight-worthy and will perform successfully under the flight environment.
(c) The system is ready to be delivered (flight items to the launch/deployment site and non-flight items to the intended operational facility) for integration/installation.
(d) The system documentation is complete and accurate.
(e) Transportation plans allow for safe delivery of a viable system.
(f) All integration activities and contingency plans have been defined.

e. Flight Readiness Review (FRR)

(1) Purpose

(a) The purpose of the FRR is to assess the overall readiness of the project to perform its science/mission objectives. More specifically, the purpose of the review is to examine tests, demonstrations, analysis, and audits to determine the system's readiness for a safe and successful launch/deployment and for subsequent flight operations. It also ensures that all flight and ground hardware, software, personnel and procedures are operationally ready.

(b) Successful completion of the FRR will result in acknowledgement that system technical and procedural maturity exists for launch and flight authorization and initiation of system operations.

(2) Timing

The flight system is ready for its mission. This review is held as close as possible to the flight date. It may be held in conjunction with reviews required by other Centers and thus may not require participation by the LaRC review panel.

(3)   Contents

   (a) Science/mission objectives revision
   (b) System status
        (i)   Significant events since the last review
        (ii)   Integration and test results
   (c) Mission operations review
        (i)   Ground support operations
        (ii)   Launch initialization plan
        (iii) Interfaces
        (iv)   Flight operations plan
        (v)   Flight initialization plan
   (d) Data retrieval and analysis
   (e) Minimum mission success criteria
   (f) Public information plan
        (i)   Contingency plans

(4)   Criteria for Successful Completion

   (a) The mission operations plan has been completely developed.
   (b) All open items and waivers have been closed. All anomalies have been addressed and corrected.
   (c) The data retrieval and analysis plan has been completely developed and all interfaces are compatible and function as expected.
   (d) The flight readiness of all operational elements, flight and ground, has been demonstrated and are properly configured and ready for launch/deployment.
   (e) The flight readiness of ground support has been demonstrated.
   (f) Plans for public information services have been developed.

f.   Lessons Learned Review

(1)   Purpose

The purpose of this review is to collect and disseminate information on experiences gained during the project lifetime. It provides the review panel with an overview of the lessons learned.

(2)   Timing

The project team is ready to do an evaluation of project activities. This is normally soon after launch and initialization.

(3)   Contents

   (a) Science/mission objectives lessons learned
   (b) Changes in objectives
        (i)   Reasons for major changes
        (ii)   Effect of changes
   (c) Project plan lessons learned
        (i)   Actuals vs. planned
        (ii)   Evaluation of Photographic Documentation Plan
   (d) Design
        (i)   Reasons for major changes
        (ii)   Design performance
   (e) Technical lessons learned
   (f) Logistics lessons learned
   (g) Public relations lessons learned
   (h) Management approach lessons learned
        (i)   Institutional and team infrastructure performance
        (ii)   Communications with other organizations
        (iii) Customer satisfaction

  (i) LLR documentation plan
  (j) Project review process lessons learned

REFERENCES

a. NPR 7120.5, "NASA Program and Project Management Processes and Requirements"
b. CID 5300.1, "Product Assurance Plan"
c. SP-6105, "NASA Systems Engineering Handbook"
d. NPR 7123.1, "Systems Engineering Procedural Requirements"